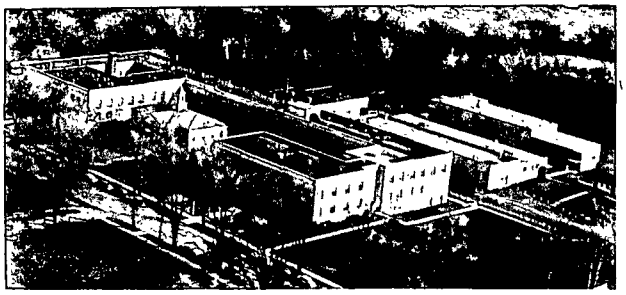

THE INSTITUTE OF PAPER CHEMISTRY, APPLETON, WISCONSIN

DEVELOPMENT OF AN IMPROVED DIFFUSION BOARD MATERIAL

Project 2256

Report Twenty-Three

A Monthly Report

to

U. S. ARMY CHEMICAL CENTER PROCUREMENT AGENCY

Report Period: August 29, 1962 to September 28, 1962

October 29, 1962

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

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Contract No. DA18-108-405-CML-941
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THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

DEVELOPMENT OF AN IMPROVED DIFFUSION BOARD MATERIAL

SUMMARY

The possibility of upgrading the gas life of board produced in any future trials at the Wood Conversion Company by incorporating repulped newspaper in the stock was considered. Boards were formed in the laboratory using repulped newspaper blended in varying proportions with a Wood Conversion Company pulp and wet-pressed at 25, 50, and 100 p.s.i. These boards were tested for density and carbon dioxide diffusivity in order to determine the proportions in which the newspaper could be incorporated with the Wood Conversion pulp. The results of the study indicate that up to 30% of the stock can be made up of repulped newspaper providing that in production operations the machine can be adjusted to produce board with a density of 22 lb./cu. ft. or less without overloading the drier as a result of increased evaporation requirements imposed by wet-pressing limitations.

LABORATORY STUDIES WITH REPULPED NEWSPAPER

BACKGROUND

Work had been conducted in the laboratory, previous to this work, with stock composed of 100% newsprint (see Report Sixteen). It was found that the few boards produced from newspaper at that time possessed good gas life and did not seem to age quite as rapidly as boards produced from other pulps; however, they tended to be somewhat denser than comparable diffusion boards and had very low diffusivities. The gas life problems encountered in the use of Wood Conversion moderately cooked aspen pulps (Reports Eighteen and Nineteen) and the poor gas life of the board produced in the two preproduction trials at the Wood Conversion

Company (Reports Nineteen and Twenty) have prompted the suggestion that the possibility of incorporating some repulped newspaper with Wood Conversion pulp in the forthcoming production trial be investigated. This has in turn led to some laboratory studies with mixtures of Wood Conversion pulp and repulped newspaper.

STOCK

A sample of stock (2256-2085-63-3) from the June 6, 1962 preproduction trials was used as the Wood Conversion component of boards formed in this study. This pulp is described in Report Twenty and it is characterized in terms of ash, solubles, pH, freeness, and screen classification in Table IX of Report Twenty. It had been stored at 40°F. at a consistency of 27.8%. The repulped newsprint was made up of newspapers, excluding colored sections, less than one month old on the basis of an assumed moisture content of 7%. The newspapers were chopped into pieces measuring less than 1/2 inch in any direction and converted into a pulp slurry by agitation with a Lightnin' mixer. One board was produced from each batch of pulp slurry.

EFFECT OF WET PRESSING

Unsized diffusion boards produced from a pulp mixture containing 75% Wood Conversion and 25% repulped newspaper were wet-pressed at 25, 50, and 100 p.s.i. for 10 minutes and tested, after drying, for caliper, density, and carbon dioxide diffusivity. The results of these tests are presented in Table I and a plot of diffusivity vs. density is shown in Fig. 1. The addition of newsprint produces a marked increase in density, as can be seen by comparison with the density of the 100% Wood Conversion board, thereby requiring drastic reductions in the degree of wet-pressing for a given density. The relationship between density and diffusivity (Fig. 1) indicates that, assuming the minimum diffusivity

of 22 x 10^{-2} sq. cm./sec. suggested in studies prior to the Institute's studies, board densities above 24 lb./cu. ft. would result in undesirably low diffusivities. Reduction in wet-pressing would result in the board carrying more water into the drier thereby complicating the drying problem, both from the standpoint of production and possible effect on CK gas life.

TABLE I

EFFECTS OF WET-PRESSING ON DIFFUSION BOARDS
CONTAINING 25% REPULPED NEWSPAPER AND 75% WOOD CONVERSION CO. PULP

Wet Pressing Conditions, p.s.i., 10 min. at	Sample No. 2256-2085	Caliper, in.	Density, lb./cu. ft.	Carbon Dioxide Diffusivity, 10^{-2} sq. cm./sec.
25	72-1	0.365	20.53	2.86
	72-2	0.359	20.68	3.04
50	72-3	0.319	22.55	2.50
	72-4	0.311	22.40	2.43
100	72-5	0.280	24.93	2.15
	72-6	0.282	25.40	2.07
100	65-2[a]	0.401	16.81	--

[a] Formed from 100% Wood Conversion Co. moderately cooked aspen pulp 2256-2085-63-2 for comparison as a board containing 0% newsprint. (This pulp is the same as 63-3 with the exception of the degree of washing.)

EFFECT OF NEWSPRINT:STOCK RATIO

Boards were formed from stocks containing from 15 to 45% newsprint and tested for caliper, density, and carbon dioxide diffusivity. These boards were unsized and each contained a 25% addition of charcoal; the wet-pressing conditions were 10 minutes at 50 p.s.i. The results of this work can be seen in Table II. While the introduction of newsprint into the stock increases the board density substantially, it is apparent from Table II that as increasing proportions of newsprint were introduced into the stock the density of the board did not change to

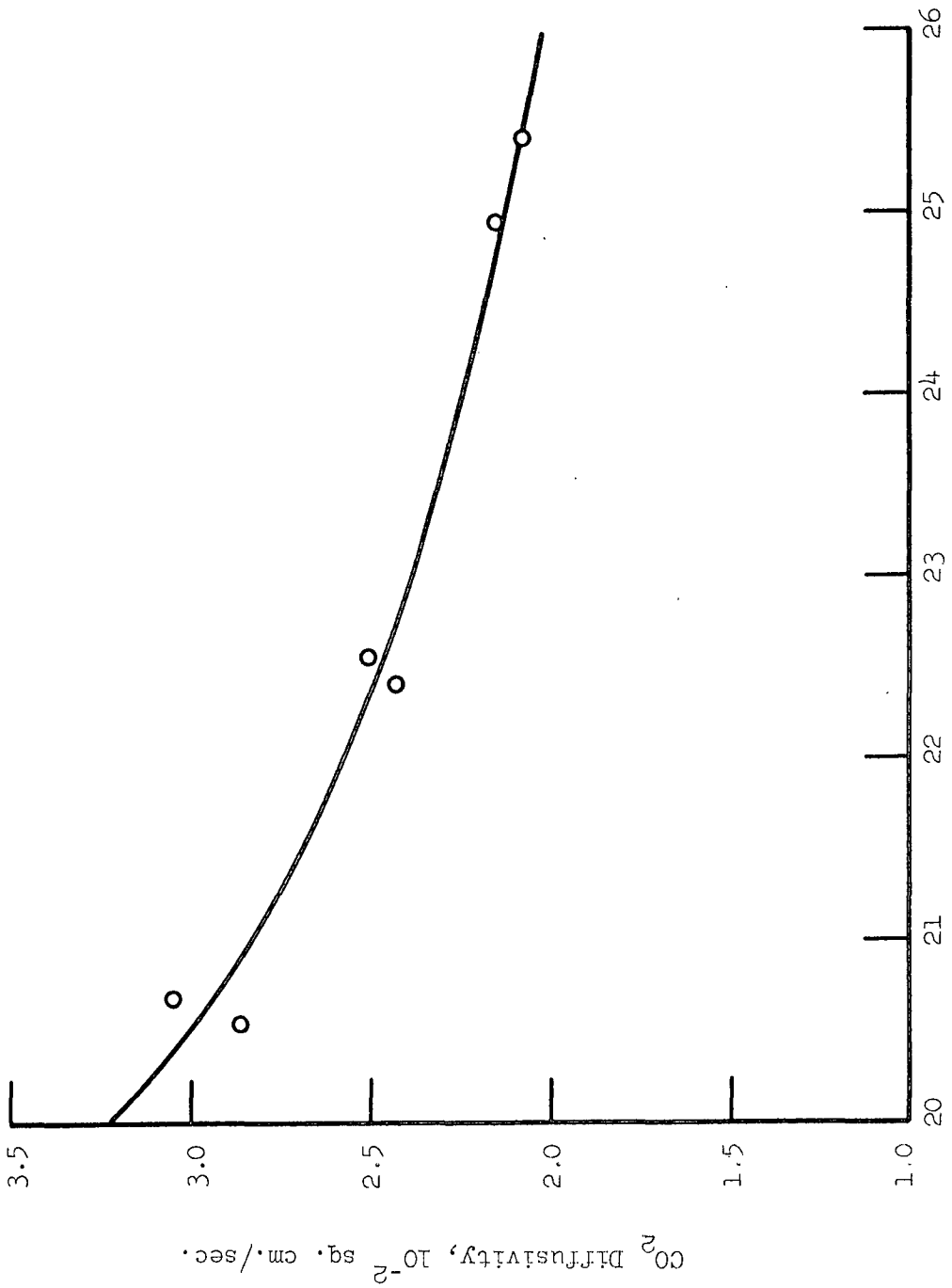

Figure 1. Carbon Dioxide Diffusivity vs. Density for Boards Made of 25% Newsprint and 75% Wood Conversion Pulp (2085-63-3)

any extensive degree. This is further illustrated by comparing the board made from 15% newsprint stock with data from previous work using 100% repulped newspaper (Report Four, Table IV) in which boards wet-pressed for 10 minutes at 150 p.s.i. attained a maximum density of 25.5 lb./cu. ft. A minimum carbon dioxide diffusivity of 1.4×10^{-2} sq. cm./sec. was obtained with the 100% repulped newspaper board which is 40% less than the diffusivity obtained with the board made from the 15% newsprint stock.

TABLE II

EFFECTS OF NEWSPRINT:STOCK RATIO ON DIFFUSION BOARD PROPERTIES

Wet-Pressing Conditions: 10 minutes at 50 p.s.i.

Newsprint Present in Stock, %	Sample No. 2256-2085	Caliper, in.	Density, lb./cu. ft.	Carbon Dioxide Diffusivity, 10^{-2} sq. cm./sec.
15	75-5	0.328	21.30	2.47
	75-6	0.325	21.28	2.47
25	72-3	0.319	22.55	2.50
	72-4	0.311	22.40	2.43
35	73-1	0.320	22.03	2.38
	73-2	0.314	22.45	2.30
35	73-4	0.392	23.00	2.32
45	73-3	0.311	22.93	2.12

If it can be assumed that the curve shown in Fig. 1 is a parameter of the newsprint content, the diffusivity values in Table II can be corrected to a given density. Correcting to a density of 22 lb./cu. ft., which seems to be the value from which the actual densities deviate, and plotting the diffusivity as a function of newsprint content seems to indicate a straight-line relationship (Fig. 2). The three points at the zero per cent newsprint axis of Fig. 2 are the corrected diffusivities of boards sampled from the first preproduction trial at the Wood Conversion Company (Report Nineteen, Table I).

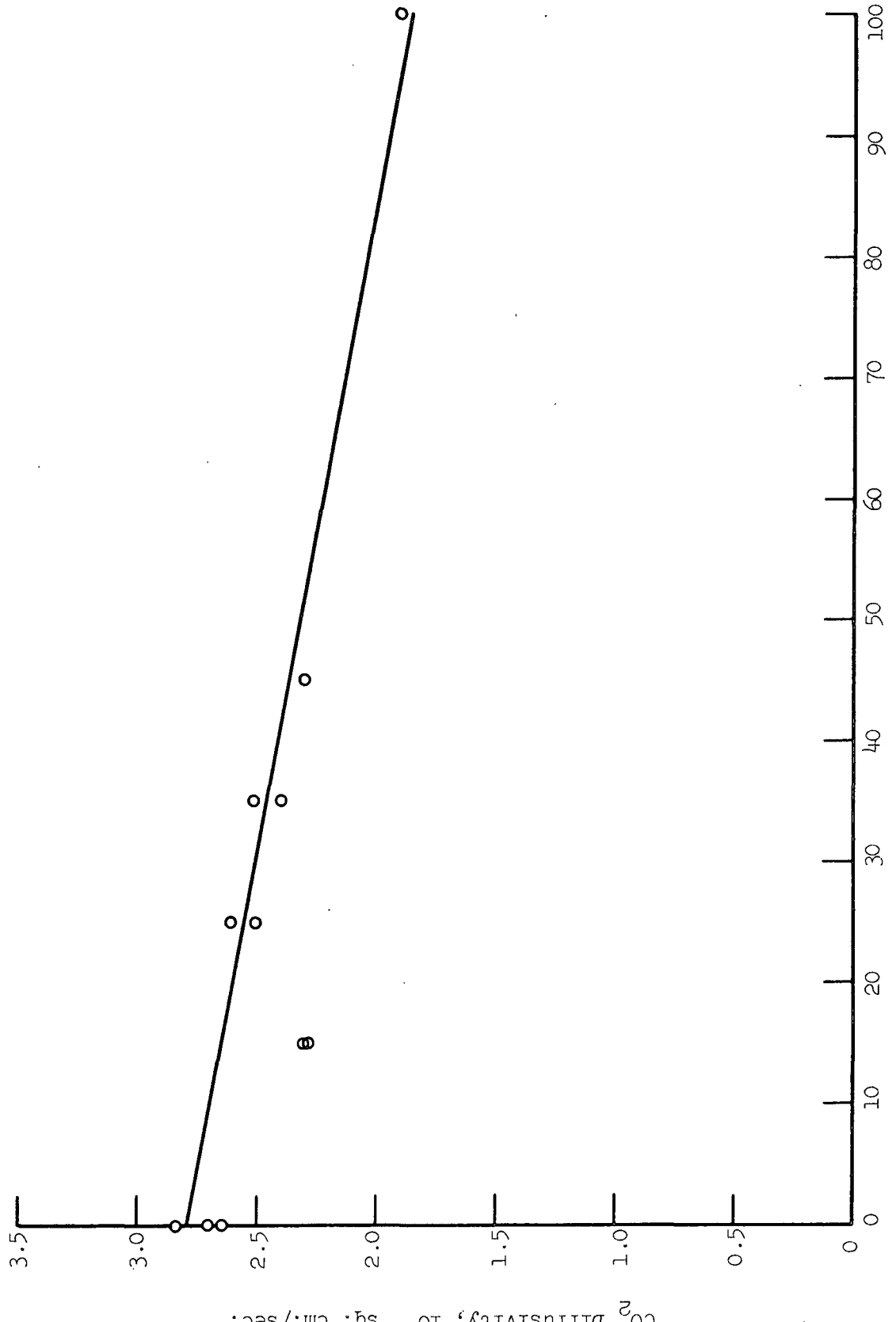

Figure 2. Carbon Dioxide Diffusivity vs. Newsprint Content of Stock. (Diffusivities Corrected to Density of 22 lb./cu. ft.)

CONCLUSIONS

This work indicates that up to 30% of the stock could be made up with repulped newspaper without seriously impairing the diffusional properties of the board providing the density could be controlled to less than 22 lb./cu. ft. This could be more difficult than is apparent from the laboratory work due to the fact that the dispersion of the newspaper in the laboratory involved minimal refining which is not likely to be the case with production equipment. The effect of the newsprint on the drainage rate, which was substantially increased in the laboratory forming operations, could result in operational problems since the amount of suction applied via the couch rolls on the machine would be limited by the wet-pressing limitations imposed by the density requirements. Thus, it is possible that machine speeds would have to be reduced to allow more drainage. However, even with increased drainage time, the limitations on wet-pressing would result in the need for increased evaporation rates in the drier which is in turn restricted as to operating temperature. In order to achieve an optimum blend of newsprint and other fiber a more projected program of study would have to be considered.

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